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Abstract

This population-based descriptive study documents fatty acid intakes in a population of older Australians. It will serve as a basis for investigations of associations between dietary fatty acid intakes and a number of eye diseases.

Keywords

intakes, acid, food, fatty, sources, population, older, australians

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Original Article

Fatty acid intakes and food sources in a population of older Australians

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Objective: To document dietary intakes and food sources of fatty acids among older Australians.
Design: Population-based survivor cohort.
Setting: Two postcode areas in the Blue Mountains, West of Sydney, Australia.
Subjects: In 1997-9, 2334 people aged 55 years and over, participated in a 5-year follow-up of the cohort attending the Blue Mountains Eye Study (BMES). Dietary data were collected using a semi-quantitative food frequency questionnaire by 2005 persons (86% of those examined). Types of fats were classified as saturated fatty acids (SFA), monounsaturated (MUFA), polyunsaturated (PUFA) and trans unsaturated fatty acids.
Results: Mean total fat intake contributed 31.3% of daily energy intake (12.2% SFA, 11.2% MUFA, 5.0% PUFA). Mean omega 3 (n-3) PUFA intake comprised 0.5% of energy intake (long chain n-3 PUFA provided mean intake of 260mg, consisting of eicosapentaenoic (EPA), docosapentaenoic (DPA) and docosahexaenoic (DHA) fatty acids) and the n-6: n-3 PUFA ratio was 9:1. The main fatty acids contributing to the diet were palmitic acid, oleic acid and linoleic acid. Meat products were the highest contributors to total fat and MUFA intakes; milk products were the highest contributor to SFA intakes; and fat spreads and oils, and breads and cereals were the main food groups contributing to PUFA intakes. Fish was the main source of long chain n-3 fatty acids.
Conclusions: This population-based descriptive study documents fatty acid intakes in a population of older Australians. It will serve as a basis for investigations of associations between dietary fatty acid intakes and a number of eye diseases.

Key Words: fatty acid, Blue Mountains Eye Study, omega-3 fatty acids, dietary intake, fish

Introduction

Dietary fats have been shown to have both positive and negative associations with many chronic diseases. Saturated fats, particularly, are implicated in coronary heart disease (CHD)[1-7], and in some forms of cancer.[8] The polyunsaturated group of fats, particularly long chain n-3 PUFAs, have demonstrated a protective effect against cardiovascular disease, and animal studies indicate anti-arrhythmic effects(9-11). Fish contain n-3 PUFA (particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)) and have been shown to be cardioprotective, and to alleviate symptoms of inflammatory and respiratory diseases.[5;12-14] More recently, n-3 PUFA appear protective against age-related macular degeneration (AMD), the major cause of blindness in Australia.[15;16] The Blue Mountains Eye Study (BMES) reported an 8.7% incidence of early AMD and a 1.1% incidence of late AMD after 5-year follow-up of a population aged 49 years and over.[17] The investigation of potential modifiable risk factors for AMD, and subsequent preventive strategies, may be an important component of efforts to reduce the impact and burden of this disease.

Recommendations for dietary fat intake vary considerably between countries.[18] The most recent Australian National Health & Medical Research Council (NHMRC) guidelines recommend: a total fat intake between 20-35% of energy, saturated fats limited to a maximum of 10% of energy, linoleic acid (18:2 n-6) of at least 13g for men and 8g for women (4-5% of energy), linolenic acid (18:3 n-3) at least 1.3g for men and 0.8g for women (0.4- 0.5% of energy) and long chain n-3 fatty acids at least 190mg for men and 90mg for women.[19]

In Australia, there have been few published reports of large population-based studies of fatty acid intakes, particularly among older people. The 1995 Australian National Nutrition Survey (NNS) reported intakes of the SFA, MUFA and PUFA in the population, aged 2 years and over (n=13 858).[20]

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However, some food categories used in the NNS have limitations, in particular, meats are categorised together but may vary in amount and type of fat.[21] In 2003, the intakes of individual fatty acids from the 1995 Australian NNS were reported by Meyer et al using an updated database of the fatty acid composition of Australian foods.[18] Blue Mountains Eye Study (BMES) data provide an opportunity to investigate fatty acid intakes and their food sources in a large population-based study of older people in Australia, using this updated food composition database. Information about the food sources of different fatty acid intakes will also inform further analyses of fatty acids and the incidence of eye diseases in this cohort of older Australians.

Materials and methods

Study Population

A population cohort of 3654 residents aged 49 years and older, living in two postcode areas of the Blue Mountains, West of Sydney, was surveyed during 1992-4 in the Blue Mountains Eye Study (BMES1), recruited using a door-knock census of the two postcode areas. After five-year follow-up, 2334 persons (75% of survivors) were re-examined in 1997-9 (BMES2); 543 (14.9%) people had died; 383 (10.5%) had moved and 394 (10.8%) refused to participate. Of these participants, 2137 attempted and returned a detailed food frequency questionnaire (FFQ), of which 2005 were usable (86% of those examined). FFQs were excluded using the protocol from BMES1(22), resulting in the following exclusions: 101 had more than 12 data items missing, 15 had estimated energy intakes exceeding 18000kJ, 4 had estimated energy intake less than 2500kJ and 12 consumed implausible amounts of food.

Overall, the BMES1 population was similar to the wider Australian population of comparable age using the 1991 national census. The BMES1 population was slightly older, with more participants aged in their 60's and 70's. A larger proportion of BMES1 participants were born in Australia or in the United Kingdom and Ireland, and had slightly higher socio-economic status, as measured by home ownership and qualifications.[23]

Food Frequency Questionnaire

Dietary data were collected using a 145-item self-administered FFQ, modified for Australian diet and vernacular from an early Willett FFQ,[24] and included reference portion sizes. Participants used a 9-category frequency scale to indicate the usual frequency of consuming individual food items during the past year. Participants were provided with written instructions and were asked to complete the FFQ before attending a detailed eye examination. The FFQ included details about the type of margarines, butters and oils used to permit a more detailed analysis of fatty acids. Dietary intakes were estimated using the Australian Tables of Food Composition (NUTTAB95)[25] and its fatty acid supplement, and additional fatty acid food composition data were added from the RMIT database[26], available on FoodWorks, version 3 (Xyris Software Pty Ltd).

Validation of dietary data

A validation study of the FFQ was conducted, using weighed food records (WFR) as the reference method for comparison.[22;27] WFR were collected over 4 days (including at least one weekend day) on three occasions during one year (n=79). The FFQ was found to show moderate to good agreement for ranking individuals according to their fat intakes, yielding correlation coefficients between 0.4-0.7 (total fat r=0.68, SFA r=0.67, MFA r=0.54, PUFA

Table 1. Fatty acid intakes, mean % energy per day and grams, g (standard deviation, SD) in the Blue Mountains Eye Study, by age and gender (women n=1153, men n=852)

Fatty acid group and type	Mean, % (SD)		Mean, g (SD)	
	Women	Men	Women	Men
Total fats	31.3 (5.9)	31.3 (6.0)	69.6 (25.4)	77.5(28.6)**
Saturated fats	12.1 (3.2)	12.3 (3.2)	27.1 (11.6)	30.6 (13.2)**
12:0 (lauric acid)	0.3 (0.2)	0.3 (0.2)	0.75 (0.5)	0.85 (0.6)**
14:0 (myristic acid)	1.0 (0.5)	1.0 (0.5)	2.4 (1.4)	2.8 (1.6)**
16:0 (palmitic acid)	5.7 (1.5)	5.8 (1.5)	12.7 (5.3)	14.5 (6.1)**
18:0 (stearic acid)	2.7 (1.0)	2.8 (0.9)	6.1 (3.1)	7.0 (3.4)**
Monounsaturated fats	11.2 (2.4)	11.3 (2.4)	24.9 (9.3)	27.9 (10.5)**
14:1 (myristoleic acid)	0.08 (0.04)	0.09 (0.04)	0.17 (0.11)	0.22 (0.13)**
16:1 (palmitoleic acid)	0.6 (0.2)	0.6 (0.2)	1.23 (0.6)	1.41 (0.72)**
18:1 (oleic acid)	9.0 (2.3)	9.1 (2.2)	20.0 (8.1)	22.7 (9.1)**
Polyunsaturated fats	5.1 (1.7)	4.9 (1.7)	11.3 (5.1)	12.1 (5.3)**
18:2 n-6 (linoleic acid)	4.0 (1.7)	4.0 (1.6)	8.9 (4.5)	9.58 (4.7) *
18:3 n-3 (linolenic acid)	0.4 (0.2)	0.4 (0.4)	0.84 (0.46)	0.93 (0.5)**
20:4 n-6 (arachidonic acid)	0.007 (0.006)	0.008 (0.007)**	0.01 (0.02)	0.02 (0.02)**
20:5 n-3 (EPA)	0.040 (0.052)	0.037 (0.055)	0.09 (0.13)	0.09 (0.14)
22:5 n-3 (DPA)	0.005 (0.005)	0.004 (0.005)	0.01 (0.01)	0.01 (0.01)
22:6 n-3 (DHA)	0.07 (0.07)	0.06 (0.06)	0.15 (0.17)	0.16 (0.18)
Total n-3 PUFA	0.5 (0.2)	0.5 (0.2)	1.09 (0.59)	1.19 (0.64)**
Long chain n-3 PUFA	0.11 (0.12)	0.11 (0.13)	0.25 (0.32)	0.26 (0.33)
Trans fats	0.15 (0.2)	0.15 (0.2)	0.33 (0.42)	0.35 (0.42)
Total n-6 PUFA	4.0 (1.7)	4.0 (1.6)	8.9 (4.5)	9.6 (4.7)*
n-6:n-3 ratio	-	-	9.0	8.9

**<0.001, *<0.05. EPA: eicosapentaenoic acid, DPA: docosapentaenoic acid, DHA: docosahexaenoic acid, PUFA: Polyunsaturated fatty acids, n-3: omega 3, n-6: omega 6.

r=0.44) and correctly classifying over 70 percent of people within one quintile for all types of fats.[22]

Statistical Analysis

Analyses were conducted using the statistical package SPSS, version 7.5 and statistical analysis tool SAS, version 8. Fatty acid intake distributions in age- and sex-stratified analyses were obtained. Students' t-test were used to determine differences in fatty acid intake between women and men; p values of <0.05 were considered significant. Individual food items were allocated to major food categories and subcategories, similar to those used in the 1995 Australian National Nutrition Survey, with some exceptions:

- soup and legumes which were categorized in the vegetable section;- pies and croissants which were categorized in a high fat dairy dessert group as the combined FFQ item included dairy dessert and cereal based desert together (cheesecake, croissant and pie);- meats which were categorized in consultation with Meat and Livestock Australia to reflect commonly used categories of cuts and dishes of red meat, divided into moderately-lean red meat (<12g/serve), medium fat red meat (12-16g/serve) and higher fat red meat (>16g/serve) (included sausages, meat pie and sausage roll). Other meat categories included processed meat (included ham, bacon, and frankfurter), organ meats (liver), and chicken (moderately-lean and high fat).

Long chain n-3 PUFA was calculated from the sum of: EPA (20:5 n-3), docosapentaenoic (DPA 22:5 n-3) and DHA (22:6 n-3). Fat intakes are expressed as either percent energy or grams, as indicated.

Results

The mean intake of total fats for the BMES2 population comprised 31.3% of the daily energy intake. Mean intakes of SFA, MUFA and PUFA were 12.2%, 11.2% and 5.0% of daily energy intakes, respectively (Table 1). There were no statistically significant differences between men and women for total fat, SFA, MUFA or PUFA (p>0.05), expressed as mean percent energy. However, absolute quantities of fatty acids were generally higher in men than women, with the exception of the LC n-3 PUFA. Persons aged 70+ years had only slightly higher intakes of total fat (p=0.028) and SFA (p<0.001) than those aged less than 70 years (31.7 % vs 31.1% for total fat; 12.5% vs 11.9% for SFA). There were no significant differences between age groups for total MUFA and PUFA intakes (data not shown). Palmitic acid was the main contributor to SFA intake, while oleic acid was the main contributor to MUFA intake. Linoleic acid was the main contributor to total PUFA and n-6 PUFA intakes and α-linolenic acid was the main contributor to n-3 PUFA intake. Total n-3 fatty acid intake contributed 0.5% to total energy (mean 1.1g) while long chain n-3 fatty acids contributed 0.1% to energy (mean 260mg). The total estimated contribution of trans fatty acids in this population was 0.15% to energy.

Table 2 presents data from comparable population-based studies, only one of which is Australian.[2;3;18;28;29] Compared with the 1995 Australian NNS, both women and men in the BMES population had higher mean intakes, in absolute amounts, for sub-categories of fat, although the percentage of energy from various types of fat was similar to our results.[18;20] The difference in absolute amounts between our study and the national survey may be partly attributable to differences in the dietary assessment methods, the NNS used 24 hour recall compared with FFQs, which may over-report absolute nutrient intakes.[22] Compared with The Health Professionals Study (USA)[3], and the Finnish cancer prevention study[29], both of which used a similar dietary assessment method to BMES, we observed markedly lower intakes of fatty acids in BMES men, especially for linoleic and linolenic acid. A comparison of women in the Nurses Health Study and BMES indicate lower intakes in BMES for percentage of energy from SFA, MUFA and particularly trans fatty acids. Intakes of PUFA were slightly higher among women in the BMES.

Table 3 shows the principal food sources of total dietary fat, SFA, PUFA, MUFA, n-6 PUFA, n-3 PUFA, and LC n-3 PUFA in the BMES population. The main contributors to total fat intake were meat, milk and milk products and fats and oils. Milk and milk products contributed most among the food groups to SFA, particularly palmitic and stearic acids. Meat and meat products also contributed to SFA and were the major contributors to MUFA intakes, mainly as oleic acid. Fats and oils were the main food sources of PUFA, contributing predominately linoleic acid and linolenic acid. Other important contributors to PUFA intake were breads and cereals, meat and nuts. Fish contributed 69% of the intake of LC n-3 PUFA, with eggs and meat dishes supplying the remainder.

Discussion

The mean daily intake of 12.2% of energy as saturated fat is greater than that currently recommended for Australians (<10% of energy per day). Mean dietary linoleic acid and linolenic acid are similar to the recently revised Nutrient Reference Values for Australia and New Zealand[19] (compare 4%, 0.4% to recommendations 4-5%, 0.4-0.5%). However these guidelines are based on calculations of population intake and vary considerably from other recommendations (see Table 4). The intake of LC n-3 PUFA of 260mg is a little higher than the secondary analysis of the National Nutrition Survey by Meyer et al (170mg in women and 210mg in men).[18] This could reflect differences due to dietary assessment methods, as FFQs have a tendency to over-estimate absolute nutrient intakes, especially with a long list of food items.[22] In addition, we observed an increasing intake of fish in this population over the period of the study, which could represent a survivor cohort bias, or growing recognition that fish may protect against eye disease and higher awareness of the link between nutrition and eye disease by this cohort of people. The intake of LC n-3 PUFA is about half that of long chain n-3 fatty acids recommended by ISSFAL (500mg) and about one quarter that recommended by the British Nutrition Foundation (BNF) (1g).[30;31] The n-6: n-3 ratio of the BMES population is approximately 9:1, which is similar to that reported by other Australian research (8:1).[32] Recommended n-6: n-3 ratios described in the literature have ranged from 2-3:1 to 6:1[10;33], indicating that it may be valuable for this population to lower its

Table 2. A comparison of fatty acid intake in the Blue Mountain Eye Study with other population- dietary studies

Source	Age (years)	Assessment method	Women, Men (n)	Mean intake % energy (g/day, if available)							
				Total fat	SFA	MUFA	PUFA	Linoleic 18:2 n-6	Linolenic 18:3 n-3	LC n-3 PUFA	Trans fats
Nurses' Health Study, 1997 (2)	34-59	FFQ	Women (80082)		15.6	16.0	4.3				2.2
NHANES 1999-2000 (47)	20-59	24 hour recall	Women (1212) Men (1490)				(16g) (20g)	(13.5g) (17.9g)	(1.3g) (1.7g)	(0.11) (0.17)	
Australian National Nutrition Survey, 1995 (20)	≥65	24 hour recall	Women (1058) Men (902)	32.1 (56.9) 31.6 (74.0)	12.4 (22.3) 12.0 (28.4)	11.4 (20.2) 11.5 (27.1)	5.1 (8.8) 4.9 (11.6)				
Australian National Nutrition Survey, 1995 (2nd analysis) (18)	≥65	24 hour recall	Women (1058) Men (902)				(8.9) (11.9)	(7.9) (10.5)	(0.86) (1.12)	(0.17) (0.21)	
Intake of n-3 fatty acids in Norwegians, 1998 (48)	16-79	FFQ	Women (1627) Men (1517)	30.6 31.5	12.2 12.3	10.7 11.1	5.3 5.7	(8.8) (13.5)	(1.2) (1.8)	0.35 0.37	
The Rotterdam Study, 2000(49)	≥55	FFQ	Women (3193) Men (2213)	36.2 36.5	14.5 14.2	12.3 12.5	6.7 7.1				
Blue Mountains Eye Study II, 1997-1999	≥55	FFQ	Women (1156) Men (859)	31.3 (69.6) 31.3 (77.5)	12.1 (27.1) 12.3 (30.6)	11.2 (24.9) 11.3 (27.9)	5.1 (11.3) 4.9 (12.1)	4.1 (8.9) 4.0 (9.6)	0.4 (0.84) 0.4 (0.93)	0.11 (0.25) 0.11 (0.26)	0.15 (0.33) 0.15 (0.35)

SFA: Saturated fatty acids, MFA: Monounsaturated fatty acids, PUFA: Polyunsaturated fatty acids, LC n-3: Long chain omega 3 polyunsaturated fatty acids, NHANES: National Health and Nutrition Education Survey.

Table 3. Main contributors to total fat, saturated fatty acid (SFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA), n-3 PUFA, n-6 PUFA and LC n-3 PUFA, among older people participating in the Blue Mountains Eye Study

Major food group	Total fat	SFA	MUFA	PUFA	n-6 PUFA	n-3 PUFA	LC n-3 PUFA
Meat and meat products	23.3	24.6	28.3	11.5	10.7	12.6	14.6
Red Meat	17.1	19.4	20.7	7.2	5.8	8.2	12.0
Moderately lean red meat	7.4	8.6	8.9	2.5	2.1	3.4	9.2
Medium fat red meat	3.2	3.4	3.9	1.9	0.5	0.8	1.8
High fat red meat	6.5	7.5	7.9	2.8	3.2	4.0	1.1
Milk and milk products	18.75	30.0	15.1	3.5	3.3	8.5	0.0
Cheese	6.6	10.5	5.4	1.3	0.9	5.7	0.0
Dairy dessert	4.6	7.2	3.7	1.2	1.0	2.3	0.0
Fats and oils	16.4	11.8	17.2	27.0	26.9	27.3	0.0
Margarine	11.0	6.2	11.2	22.5	22.5	18.7	0.0
Butter	3.8	4.9	3.7	2.0	1.8	5.4	0.0
Cereal based products and dishes†	8.16	10.0	7.8	6.2	4.4	6.0	2.3
Breads, cereals, & cereal products	6.0	3.9	3.9	13.2	13.3	8.1	0.0
Vegetables	8.30	5.4	8.9	9.4	10.6	4.4	0.0
Nuts	5.3	1.9	6.3	11.5	13.9	6.5	0.0
Fish and seafood	4.0	3.8	4.2	6.9	4.2	21.3	69.0
Eggs	3.9	3.5	4.4	3.1	3.3	2.8	15.1
Confectionary	2.7	4.1	2.5	0.7	0.8	0.8	0.0
Other foods‡	2.9	1.0	1.6	7.0	8.8	1.9	0.0

† Includes biscuits, cakes and pastries, ‡Other foods include non-alcoholic and alcoholic beverages, fruit, savoury sauces, yeast extracts, potato crisps. SFA: Saturated fatty acids, MFA: Monounsaturated fatty acids, PUFA: Polyunsaturated fatty acids, LC n-3: Long chain omega 3 polyunsaturated fatty acids, n-3: omega 3, n-6: omega 6.

Table 4. Recommended guidelines for fatty acid intake

Recommendation Source	Total fat	SFA	PUFA	n-6 PUFA	Linoleic 18:2 n-6	Linolenic 18:3 n-3	LC n-3 PUFA
NHF, 1999, Australia[50]		<8%†	10%	8-10% (16-20g)		≥1% (2g)	0.08-0.22% (160-430mg) ‡
NHMRC, Australia, 2006[19]	20-35%	<10%†			4-5% (13g men; 8g women)	0.4-0.5% (1.3g men, 0.8g women)	190mg men, 90mg women
British Nutrition Foundation, 1992[51]					6% (12g)	1% (2g)	0.5% (1000mg)
US Dietary Guidelines[52]	20-35%	<10%			7% (12-15g)	1.1-1.35g	135mg
ISSFAL 2004[30]					2%	0.7%	>500mg (EPA+DHA)

NHF: National Heart Foundation, NHMRC: National Health and Medical Research Council, ISSFAL: International Society for the Study of Fatty acids and Lipids, EPA: eicosapentaenoic acid, DHA: docosahexaenoic acid. † includes *trans* fats, ‡ fish sources recommended; fish recommended as 2 serves per week.

ratio of n-6: n-3 fatty acids, by a combination of reducing total dietary n-6 fatty acids and increasing dietary n-3 fatty acids.[34]

The total energy contribution of trans fatty acids was low in the BMES cohort, compared to the Nurses Health Study (0.15% of energy compared to 2.2% of energy respectively).[2] Such differences in diet reflect, in part, differences in composition of foods in Australia and the United States. In the past ten years, Australia has reduced the proportion of trans fats in processed foods.[32;35] However, it is possible that we underestimated trans fat intake because the fatty acid database of Australian foods is

limited to products chemically assayed for trans fatty acids, with many food products yet to be assessed.[26]

Examination of the foods contributing to total fat and subtypes of fat consumed by this population provides information about the sources of various fats in older populations. Better food choices can help reduce total fat and SFA intakes and at the same time increase the proportion of PUFA and MUFA in the diet. The main food sources for n-6 PUFA and n-3 PUFA were from similar products: fats and oils, meat and meat products, breads and cereals and nuts. The main food sources of long-chain n-3 PUFA were fish, meat and eggs. Due to the complexity of different fatty acids found in the same foods, nutrition education messages require more complex responses than simply suggesting the substitution of one food for another. Improvements in processing that result in foods with better fatty acid profiles are more likely to result in population changes.[36]

There is current interest in increasing the long chain n-3 fatty acid content of foods in Australia[32], through regulation by Food Standards Australia and New Zealand (FSANZ). To this end, initial guidelines recommend that foods claiming to be a good source of omega-3 fatty acids should contain no less than 200mg alpha-linolenic acid or no less than 30 mg total EPA and DHA per serving. The guidelines also state that such foods should contain no more than 28 percent of saturated fatty acids and trans fatty acids in relation to the total fatty acid content of the food, and no more than five grams saturated and trans fatty acids per 100g of foods.[37] Continued efforts by the food industry to minimize trans fatty acid content of foods and to fortify foods with long chain n-3 PUFA may lead to improvements in the fatty acid intake of individuals.

There are historical examples of populations that obtained higher n-3 intakes, in particular higher intakes of long chain n-3 fatty acids, and corresponding lower n-6 intakes, such as in the paleolithic, traditional Eskimo and Japanese diets.[31;38;39] These intakes were achieved mainly by substantially higher fish intakes and the use of very lean red meat (e.g. from game products). It has been reported, however, that if each person consumed at least two fish meals per week, as currently recommended, the world's fish stocks would diminish rapidly to the point where the extinction of many species may be threatened.[40;41] Alternative sources of long chain n-3 fatty acids are currently under investigation, such as the incorporation of microalgal organisms into land plants.[42] This is an expensive method, however, and at this time, its widespread application is not feasible. Alternatives are the fortification of some foods with LC n-3 PUFA. This has already occurred for example with fortified egg and bread products, using either fish meal to feed chickens and microencapsulating fish oils which can be added to foods without producing a 'fishy' taste.[43] This method, however, still essentially requires the use of limited fish resources. Another alternative is to increase the LC n-3 PUFA content of land plants, recently demonstrated in a seed plant by Robert *et al.*[44] Further, recent research has shown that lean red meat from predominantly pasture fed animals in Australia, provide higher LC n-3 PUFA concentrations than grain fed meat.[45]

In addition, recommendations to increase fish intake may lead to consumer concerns about mercury toxicity, and thus will require carefully constructed health messages. For the general population, 2-3 fish serves (150g each serve) are considered safe.[46] However, women of childbearing age, pregnant women and young children (less than 6 years of age) are advised to limit their intake of fish containing high levels of methylmercury to one serve (150g for adults, 75g for children) per week or to consume up to 2-3 serves of other fish per week. Older and larger predatory fish, including shark/flake, swordfish, broadbill, marlin, catfish and orange roughy, tend to accumulate higher amounts of methylmercury.[46]

In conclusion, this study has documented fatty acid intakes of older Australians for the period 1997-1999, and has compared these with Australian and International dietary recommendations. Due to the complexity of different fatty acid compositions found in foods, particularly the occurrence of n-3 and n-6 PUFA in many of the same foods, nutrition education messages require more complex responses than simply suggesting the substitution of one food for another. At the present time the most effective means of increasing n-3 PUFA intakes, while minimising n-6 PUFA intake, is by increasing fish intake and/or using n-3 PUFA fortified foods. Including pasture fed lean red meat in the diet will also enhance n-3 PUFA intake. Further development of technologies to improve n-3 PUFA content of seeds and grains may increase the range of good sources of n-3 PUFA in the future. Findings from this study provide a basis for conducting further analyses of the relationship between particular fatty acids and the incidence of chronic diseases. Of particular interest for further investigation in the BMES cohort is the relationship between dietary fatty acid intake and eye diseases, principally age-related macular degeneration and retinal vessel wall signs. Future analyses of links between fatty acids and eye health may assist in the development of public health recommendations concerning nutrients and foods shown to be protective for eye diseases.

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